

REMARKS

Please reconsider the application in view of the above amendments and the following remarks. Applicant thanks the Examiner for carefully considering this application. Further, the Applicant thanks the Examiner for acknowledging the claim to foreign priority of the present application.

The Applicant respectfully notes that the Examiner has indicated that an Information Disclosure Statement was included, however there is no paper number in the available space and an initialed PTO-1449 form was not attached. The Applicant thanks the Examiner in advance for forwarding an initialed copy of the PTO-1449.

I. Disposition of Claims

Claims 1-19 are pending in this application. Claims 1, 11, and 12 are independent. The remaining claims depend, directly or indirectly, from claims 1, 11, and 12. Claims 1, 10-12, 13, 16, and 18 have been amended in this reply. No new matter has been added by way of these amendments.

I. Rejection(s) under 35 U.S.C § 102

Claims 1-5, 7-9, 12, and 14 were rejected under 35 U.S.C. § 102(a) as being anticipated by U.S. Patent No. 5,432,392 ("Kadota"). Claims 1 and 12 have been amended in this reply to clarify the present invention recited. To the extent that this rejection may still apply to the amended claims, the rejection is respectfully traversed.

The Present Invention

The present invention relates to a surface acoustic wave substrate. The surface acoustic wave substrate includes a piezoelectric or electrostrictive substrate having a large electromechanical coupling coefficient and a thin silicon oxide (SiO_2) film formed on the substrate. The SiO_2 film has variation characteristics of frequency. In particular, the SiO_2 film has a surface acoustic wave relative temperature variation, which is opposite to that of the substrate.

In the present invention, the substrate is a LiNbO_3 (or abbreviated as "LN") substrate. This substrate has a cut angle of a rotated Y plate within a range greater than or equal to -10° and smaller than or equal to 30° . The substrate also propagates a piezoelectric leaky surface wave, which has a propagation velocity higher than that of a Rayleigh type acoustic wave along X-axis direction or within a range of plus or minus 5° with respect to X-axis direction.

Further, a value of a ratio between the film thickness (H) of the thin SiO_2 film to the wavelength (λ) of the operating center frequency of the piezoelectric leaky surface wave is between 0.05 to 0.35.

Advantageously, the present invention provides a surface acoustic wave substrate and a surface acoustic wave element having an electromechanical coupling coefficient k^2 greater than the prior art, in addition to good temperature characteristics.

The Present Invention v. Kadota

Kadota fails to disclose all of the elements of the present invention as recited in

independent claims 1 and 12, as amended. For example, Kadota discloses a surface wave device and primarily focuses on a ZnO film and a LN substrate (or abbreviated as “ZnO/LN”). Kadota only discloses a SiO₂ film and a LN substrate (or abbreviated as “SiO₂/LN”) in Table 1. In Table 1, Kadota shows temperature coefficient of frequencies (TCF), wave types, and a electromechanical coupling coefficients. For the SiO₂/LN structure, Kadota discloses a TCF of 0 ppm/°C, a Rayleigh wave type, and a 27.6% electromechanical coupling coefficient.

However, claim 1 requires that “a value of H/λ falls within a range from 0.05 to 0.35.” Further, claims 12 requires that “a value of H/λ falls within a range from 0.05 to 0.35 in an exciting or receiving region, and within 0.05 to 0.35 in a propagating region.” Kadota does not show or suggest a relationship between the SiO₂/LN and the H/λ ratio. In fact, Kadota only discloses a relationship between the ZnO/LN and the H/λ ratio as required by amended claims 1 and 12.

Additionally, claims 1 and 12 require that “a thin SiO₂ film... having a variation characteristics of frequency of a surface acoustic wave relative temperature variation opposite to that of said substrate.” In other words, the TCF of the SiO₂ film is opposite of that of the TCF of the LN substrate. Advantageously, the resultant surface acoustic wave element is permitted to have a zero or low TCF.

In contrast, Kadota is completely silent to such a feature. Kadota discloses a ZnO film having a TCF of 25 to 32 ppm/°C and a LN substrate 30 ppm/°C. In this case, the resultant piezoelectric substrate has a TCF limited to 25 to 32 ppm/°C.

Because Kadota fails to disclose all of the elements of independent claims 1 and 12, the present invention is patentable over Kadota. Claims 2-5, 7-9, and 14, which

depend from claims 1 or 12, are patentable for at least the same reasons as stated above. Accordingly, withdrawal of the §102 rejection with respect to claims 1-5, 7-9, 12, and 14 is respectfully requested.

III. Rejection(s) under 35 U.S.C § 103

Kadota

Claims 6 and 10 were rejected under 35 U.S.C. § 103(a) as being obvious over Kadota. Claims 6 and 10 depend from claim 1. As discussed above, Kadota fails to teach all of the elements of claim 1. Therefore, claims 6 and 10 are patentable for at least the reasons as stated above. Additionally, with respect to claim 10, Kadota unconditionally asserts that “the ratio H/λ *must* be set in a range of 0.05 to 0.2 in the present invention,” (col. 5, ll. 43-45). In contrast, claim 10 recites a range of “0.25 to 0.31.” In view of the clear disclaimer in Kadota, the Applicant is unclear as to why a person of ordinary skill would seek to extend beyond this range. Accordingly, withdrawal of the §103 rejection with respect to these claims is respectfully requested.

Kadota and Yoshida

Claims 11, 13, and 15-19 were rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 6,426,584 (“Yoshida”) in view of Kadota. Claims 11 and 12 have been amended in this reply to clarify the present invention recited. To the extent that this rejection may still apply to the amended claims, the rejection is respectfully traversed.

As previously stated, Kadota fails to teach the ratio of thin film thickness H to

wavelength λ of operating center frequency of the piezoelectric leaky surface wave with respect to thin SiO₂ film, as recited in the claims. In particular, Kadota fails to teach that “a value of H/λ falls within a range from 0.05 to 0.35,” as recited by claim 11. Additionally, Kadota fails to teach “a value of H/λ falls within a range from 0.05 to 0.35 in an exciting or receiving region, and within 0.05 to 0.35 in a propagating region,” as recited by claim 12.

It is unclear to the Applicant why a person of ordinary skill in the art would substitute the thin film materials, particularly, when the teachings of Kadota relate primarily to one thin film material, *i.e.*, ZnO, rather than SiO₂ as required by newly amended claims. Furthermore, it is unclear to the Applicant why a person of ordinary skill in the art would contemplate a range for a material that was not taught by Kadota with any level of specificity and a range whose upper end substantially exceeds the range that has been clearly and unconditionally established in Kadota.

Additionally, Kadota fails to teach or suggest the temperature coefficient frequencies as recited in the claims. In particular, Kadota fails to teach “a thin SiO₂ film ...having a variation characteristics of frequency of a surface acoustic wave relative temperature variation opposite to that of said substrate,” as recited in claims 11 and 12.

Yoshida fails to provide that which Kadota lacks with respect to these independent claims. Yoshida simply discloses a surface acoustic wave (SAW) device having an interdigital electrode or a grating reflector on a LN substrate. However, Yoshida is completely silent to the claimed features, which Kadota lacks.

Because Yoshida fails to teach that which Kadota lacks, claims 11 and 12 are patentable over Yoshida and Kadota, whether considered separately or in combination.

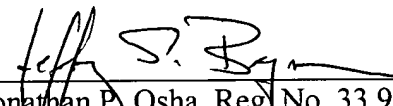
Claims 13 and 15-19 are likewise patentable for at least the same reasons. Accordingly, withdrawal of the §103 rejection with respect to claims 11, 13, and 15-19 is respectfully requested.

IV. Conclusion

Applicant believes this reply is fully responsive to all outstanding issues and places this application in condition for allowance. If this belief is incorrect, or other issues arise, the Examiner is encouraged to contact the undersigned or his associates at the telephone number listed below. Please apply any charges not covered, or any credits, to Deposit Account 50-0591 (Reference Number 08440.003001).

Respectfully submitted,

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